

**IN THE CLAIMS:**

Please write the claims to read as follows:

Please cancel claims 16, 28, 32, 39, 46, and 53 without prejudice.

1 1. (Currently Amended): A policer based on Random Early Detection (RED), compris-  
2 ing:

3 a filter ~~that determinesto~~ determine a filtered virtual time debt, the filtered virtual  
4 time debt determined based on an average difference between a time packets are expected  
5 to arrive and a time the packets actually arrive; and

6 a control law circuit ~~that receives~~ to receive the filtered virtual time debt from the  
7 filter and ~~determines~~ to determine whether a packet should be dropped.

1 2. (Currently Amended): The RED policer of claim 1, wherein a virtual time debt ~~uses~~ is  
2 configured to use a time T in which a packet is expected to arrive and is computed using  
3 a predetermined output transmission rate.

1 3. (Original): The RED policer of claim 2, wherein predetermined output transmission  
2 rate is given by a traffic contract.

1 4. (Previously Presented): The RED policer of claim 1, wherein the filter is based on an  
2 exponential weighted moving average (EWMA) virtual time delay using the expression,

3 
$$EWMA_k = (1-g)EWMA_{k-1} + g(VTD)_k,$$

4           where k indicates the presently received packet, and k-1 indicates the last packet  
5     received, the virtual time debt (VTD) is computed by the expression:  $VTD = T(\text{packet}$   
6     expected to arrive) – T(packet actually arrives), and g is the gain of the filter.

1     5. (Currently Amended): The RED policer of claim 1, further ~~comprises~~comprising: a  
2     sampler ~~that samples~~to sample a virtual time debt at a sampling interval, and ~~transmits to~~  
3     transmit the sampled virtual time debt to the filter.

1     6. (Currently Amended): The RED policer of claim 1, further ~~comprises~~comprising:  
2           a random generator ~~that generates~~to generate a number based on the control law  
3     circuit's determination as to whether a packet should be dropped; and

4           a counter ~~that is configured to be~~ set with the number generated by the random  
5     generator, wherein the counter ~~counts~~is configured to count packets passing through the  
6     RED policer up to the set number, and wherein the RED policer ~~drops~~is configured to  
7     drop a packet when the counter has counted out the set number.

1     7. (Currently Amended): The RED policer of claim 6, further ~~comprises~~comprising:  
2           the control law circuit ~~that determines~~to determine a probability of a packet being  
3     dropped based on the filtered time debt exceeding a predetermined minimum threshold,  
4     and ~~specifies to specify~~ a range of numbers based on the probability; and

5           the random generator ~~that to randomly generates~~generate a number in the range  
6     specified by the control law circuit.

1     8. (Currently Amended): A policer based on Random Early Detection (RED), compris-  
2     ing:

3 means for determining a moving average of a virtual time debt, the virtual time  
4 debt determined based on a difference between a time packets are expected to arrive and  
5 a time the packets actually arrive; and

6 means for determining whether a packet should be dropped based on a value of  
7 the moving average of the virtual time debt.

1 9. (Original): The RED policer of claim 8, further comprises means for sampling a vir-  
2 tual time debt at a sampling interval, and transmitting the result to the moving average  
3 determining means.

1 10. (Original): The RED policer of claim 8, further comprises:

2 means for generating a random number based on the result of the packet dropping  
3 means; and

4 means for counting a number of packets passing through the RED policer up to  
5 the random number generated by the random number generating means, wherein the  
6 RED policer drops a packet when the counting means has counted out the generated ran-  
7 dom number.

1 11. (Currently Amended): A network device comprising:

2 a plurality of Random Early Detection (RED) policers, wherein each RED policer  
3 ~~includes~~comprises,

4 a filter ~~that determines~~ to determine a filtered virtual time debt, the filtered  
5 virtual time debt determined based on an average difference between a time pack-  
6 ets are expected to arrive and a time the packets actually arrive; and

7                   a control law circuit ~~that receives~~to receive the filtered virtual time debt  
8                   from the filter and ~~determines~~to determine whether a packet should be dropped;  
9                   and  
10                  a packet classifier ~~that determines~~to determine which packet should go to which  
11                  RED policer.

1    12. (Currently Amended): A method of policing packets in a network device, the  
2    method comprising the steps of:

3                  determining a filtered virtual time debt of a traffic, the filtered virtual time debt  
4                  determined based on an average difference between a time packets of the traffic are ex-  
5                  pected to arrive and a time the packets actually arrive;

6                  comparing the filtered virtual time debt with a predetermined minimum threshold;  
7                  and if the filtered virtual time debt exceeds the minimum threshold, then

8                  generating a random number that is used to determine which packet should be  
9                  dropped.

1    13. (Original): The method of claim 12, wherein generating a random number further  
2    comprises the steps of:

3                  generating the random number in a range based on a level by which the filtered  
4                  virtual time debt exceeds the minimum threshold;

5                  setting a counter with the random number; and

6                  dropping a packet when the counter has counted out the random number.

1    14. (Currently Amended): A computer readable medium having instructions contained  
2    therein, which when executed by a computer performs a method comprising the steps of:

3           determining a filtered virtual time debt of a traffic, the filtered virtual time debt  
4 determined based on an average difference between a time packets of the traffic are ex-  
5 pected to arrive and a time the packets actually arrive;

6           comparing the filtered virtual time debt with a predetermined minimum threshold;  
7 and if the filtered virtual time debt exceeds the minimum threshold, then

8           generating a random number that is used to determine which packet should be  
9 dropped.

1   15. (Original): The medium of claim 14, wherein generating a random number further  
2 comprises the steps of:

3           generating the random number in a range based on a level the filtered virtual time  
4 debt exceeds the minimum threshold;

5           setting a counter with the random number; and

6           dropping a packet when the counter has counted out the random number.

1   16. (Canceled).

1   17. (Currently Amended): A method of policing packets in a network device, the  
2 method comprising the steps of:

3           determining a filtered virtual time debt of packets flowing through the network  
4 device, the filtered virtual time debt determined based on an average difference between a  
5 time packets are expected to arrive and a time the packets actually arrive; and

6           determining whether a packet should be dropped based on the filtered virtual time  
7 debt of the packets.

1 18. (Previously Presented): The method as in claim 17, further comprising: determining  
2 that a packet should be dropped when a virtual time debt threshold has been reached.

1 19. (Previously Presented): The method as in claim 17, further comprising: determining  
2 a moving average of the virtual time debt.

1 20. (Previously Presented): The method as in claim 17, further comprising: calculating  
2 the virtual time debt as the difference between a time a packet is expected to arrive and a  
3 time the packet actually arrives.

1 21. (Previously Presented): The method as in claim 20, further comprising: calculating  
2 the time a packet is expected to arrive according to a traffic contract.

1 22. (Previously Presented): The method as in claim 17, further comprising: sampling the  
2 virtual time debt at a sampling interval.

1 23. (Previously Presented): The method as in claim 17, further comprising:  
2 generating a random number;  
3 counting a number of packets passing through the network device up to the ran-  
4 dom number; and  
5 dropping a packet when the counted number reaches the random number.

1 24. (Currently Amended): A method of policing packets in a network device, the  
2 method comprising the steps of:

3           determining a filtered virtual time debt of packets flowing through the network  
4   device, the filtered virtual time debt computed as an average positive delay from an ex-  
5   pected packet arrival time established by a traffic contract to an actual packet arrival  
6   time;

7           determining that packets should be dropped when the filtered virtual time debt of  
8   the packets exceeds a predetermined value; and if so

9           choosing a packet to be dropped, the chosen packet in response to a random num-  
10   ber; and

11          dropping the chosen packet.

1   25. (Currently Amended): The method as in claim 24, further comprising:

2           generating the random number;

3           counting a number of packets passing through the network device up to the ran-  
4   dom number; and

5           dropping a packet when the counted number reaches the random number.

1   26. (Currently Amended): A policer, comprising:

2           means for determining a filtered virtual time debt of packets flowing through the  
3   network device, the virtual time debt computed as an average positive delay from an ex-  
4   pected packet arrival time established by a traffic contract to an actual packet arrival  
5   time;

6           means for determining that packets should be dropped when the virtual time debt  
7   of the packets exceeds a predetermined value; and if so

8           means for choosing a packet to be dropped, the chosen packet in response to a  
9   random number; and

10 means for dropping the chosen packet.

1 27. (Currently Amended): A computer readable media, the computer readable media  
2 containing instructions for execution in a processor for the practice of the method com-  
3 prising the steps of:

4 determining a filtered virtual time debt of packets flowing through the network  
5 device, the filtered virtual time debt determined based on an average difference between a  
6 time packets are expected to arrive and a time the packets actually arrive; and

7 determining whether a packet should be dropped based on the filtered virtual time  
8 debt of the packets.

1 28. (Canceled).

1 29. (Currently Amended): A method of policing packets in a network device, the  
2 method comprising the steps of:

3 determining a filtered virtual time debt of packets flowing through the network  
4 device, the filtered virtual time debt computed as an average positive delay from an ex-  
5 pected packet arrival time to an actual packet arrival time; and

6 determining whether a packet should be dropped based on the filtered virtual time  
7 debt of the packets.

1 30. (Previously Presented): The method as in claim 29, in the event a packet should be  
2 dropped, further comprising:

3 generating a random number;



4 counting a number of packets passing through the network device up to the ran-  
5 dom number; and  
6 dropping a packet when the counted number reaches the random number.

1 31. (Currently Amended): A method of policing packets in a network device, compris-  
2 ing:

3 determining an actual arrival time of a packet;  
4 determining a theoretical arrival time of the packet;  
5 calculating a virtual time debt in response to the actual arrival time and the theo-  
6 retical arrival time;

7 using a filter to determine a filtered virtual time debt of a traffic, the filtered vir-  
8 tual time debt determined based on an average of a plurality of virtual time debts for the  
9 traffic;

10 comparing the filtered virtual time debt with a predetermined value;  
11 deciding if the filtered virtual time debt exceeds the predetermined value; and  
12 generating, in response to the filtered virtual time debt exceeding the predeter-  
13 mined value, a random number that is used to determine which packet should be dropped.

1 32. (Canceled).

1 33. (Currently Amended): The method of claim 31, further comprising:

2 ~~using a time T in which the packet is expected to arrive; and~~  
3 computing a predetermined output transmission rate.

1 34. (Previously Presented): The method of claim 33, further comprising:

2 setting the predetermined output transmission rate by a traffic contract.

1 35. (Currently Amended): The method of claim ~~32~~31, further comprising:

2 sampling the virtual time debt at a sampling interval; and

3 transmitting the sampled virtual time debt to the filter.

1 36. (Currently Amended): The method of claim 31, further comprising:

2 using a counter that is set with the generated random number ~~generated by the~~  
3 ~~random number generator~~;

4 counting packets passing through a RED policer up to the set number;

5 dropping the packet when the counter has counted out the set number.

1 37. (Currently Amended): The method of claim 31, further comprising:

2 determining a moving average ~~of~~ for the filtered virtual time debt; ~~and~~

3 ~~determining whether a packet should be dropped based on a value of the moving~~  
4 ~~average of the virtual time debt.~~

1 38. (Currently Amended): A policer based on Random Early Detection (RED), compris-  
2 ing:

3 an operating system ~~determines to~~ determine an actual arrival time of a packet and  
4 a theoretical arrival time of the packet;

5 a control law circuit ~~that calculates to~~ i) calculate a virtual time debt in response to  
6 the actual arrival time and the theoretical arrival time,

7        a filter to determine a filtered virtual time debt of a traffic, the filtered virtual time  
8        debt determined based on an average of a plurality of virtual time debts for the traffic;

9        the control law circuit further to ii) ~~compares~~ compare the filtered virtual time  
10       debt with a predetermined value, and iii) ~~decides~~ decide if the filtered virtual time debt  
11       exceeds the predetermined value; and

12       a random number generator ~~that generate~~ to generate, in response to the filtered  
13       virtual time debt exceeding the predetermined value, a random number that is used to de-  
14       termine which packet should be dropped.

1       39. (Canceled).

1       40. (Currently Amended): The policer of claim 38, further comprising:

2       the filtered virtual time debt ~~uses~~ is configured to use time T in which the packet  
3       is expected to arrive, and is computed using a predetermined output transmission rate.

1       41. (Previously Presented): The policer of claim 40, further comprising:

2       the predetermined output transmission rate is given by a traffic contract.

1       42. (Currently Amended): The policer of claim ~~39~~38, further comprising:

2       a sampler ~~that sample~~ to sample the virtual time debt at a sampling interval and  
3       ~~transmits to~~ transmit the sampled virtual time debt to the filter.

1       43. (Currently Amended): The policer of claim 38, further comprising:

2 a counter ~~that is~~configured to be set with the number generated by the random  
3 number generator, and ~~counts~~configured to count packets passing through the RED poli-  
4 cer up to the set number; and

5 the RED policer ~~drops~~configured to drop the packet when the counter has  
6 counted out the set number.

1 44. (Currently Amended): The policer of claim 38, further comprising:

2 ~~a the filter that determines~~further to determine a moving average ~~of~~ for the filtered  
3 virtual time debt,~~; and~~

4 ~~a control law circuit that determines whether a packet should be dropped based on~~  
5 ~~a value of the moving average of the virtual time debt.~~

1 45. (Currently Amended): An apparatus for policing packets in a network device, com-  
2 prising:

3 means for determining an actual arrival time of a packet;

4 means for determining a theoretical arrival time of the packet;

5 means for calculating a virtual time debt in response to the actual arrival time and  
6 the theoretical arrival time;

7 means for using a filter to determine a filtered virtual time debt of a traffic, the fil-  
8 tered virtual time debt determined based on an average of a plurality of virtual time debts  
9 for the traffic;

10 means for comparing the filtered virtual time debt with a predetermined value;

11 means for deciding if the filtered virtual time debt exceeds the predetermined  
12 value; and

13 means for generating, in response to the filtered virtual time debt exceeding the  
14 predetermined value, a random number that is used to determine which packet should be  
15 dropped.

1 46. (Canceled).

1 47. (Currently Amended): The apparatus of claim 45, further comprising:

2 ~~means for using a time T in which the packet is expected to arrive; and~~  
3 means for computing a predetermined output transmission rate.

1 48. (Previously Presented): The apparatus of claim 47, further comprising:

2 means for setting the predetermined output transmission rate by a traffic contract.

1 49. (Previously Presented): The apparatus of claim 46, further comprising:

2 means for sampling the virtual time debt at a sampling interval; and  
3 means for transmitting the sampled virtual time debt to the filter.

1 50. (Previously Presented): The apparatus of claim 45, further comprising:

2 means for using a counter that is set with the number generated by the random  
3 number generator;  
4 means for counting packets passing through a RED policer up to the set number;  
5 means for dropping the packet when the counter has counted out the set number.

1 51. (Currently Amended): The apparatus of claim 45, further comprising:  
2 means for determining a moving average ~~of~~ for the filtered virtual time debt; ~~and~~  
3 ~~means for determining whether a packet should be dropped based on a value of~~  
4 ~~the moving average of the virtual time debt.~~

1 52. (Currently Amended): A computer readable medium having instructions contained  
2 therein, which when executed by a computer performs a method comprising the steps of:  
3 determining an actual arrival time of a packet;  
4 determining a theoretical arrival time of the packet;  
5 calculating a virtual time debt in response to the actual arrival time and the theo-  
6 retical arrival time;  
7 using a filter to determine a filtered virtual time debt of a traffic, the filtered vir-  
8 tual time debt determined based on an average of a plurality of virtual time debts for the  
9 traffic;  
10 comparing the filtered virtual time debt with a predetermined value;  
11 deciding if the filtered virtual time debt exceeds the predetermined value; and  
generating, in response to the filtered virtual time debt exceeding the predeter-  
mined value, a random number that is used to determine which packet should be dropped.

1 53. (Canceled).

Please insert the following new claims 54 *et seq.*:

- 1 54. (New): The RED policer of claim 1, further comprising: the filter further configured  
2 to calculate the average as an exponential weighted moving average (EWMA).
- 1 55. (New): The RED policer of claim 8, further comprising: means for calculating the  
2 average as an exponential weighted moving average (EWMA).
- 1 56. (New): The network device of claim 11, further comprising: the filter further con-  
2 figured to calculate the average as an exponential weighted moving average (EWMA).
- 1 57. (New): The method of claim 12, further comprising: calculating the average as an  
2 exponential weighted moving average (EWMA).
- 1 58. (New): The medium of claim 14, further comprising the step of: calculating the av-  
2 erage as an exponential weighted moving average (EWMA).
- 1 59. (New): The method of claim 17, further comprising: calculating the average as an  
2 exponential weighted moving average (EWMA).
- 1 60. (New): The method of claim 24, further comprising: calculating the average as an  
2 exponential weighted moving average (EWMA).

1 61. (New): The policer of claim 26, further comprising: means for calculating the aver-  
2 age as an exponential weighted moving average (EWMA).

1 62. (New): The medium of claim 27, further comprising the step of: calculating the av-  
2 erage as an exponential weighted moving average (EWMA).

1 63. (New): The method of claim 29, further comprising: calculating the average as an  
2 exponential weighted moving average (EWMA).

1 64. (New): The method of claim 31, further comprising: calculating the average as an  
2 exponential weighted moving average (EWMA).

1 65. (New): The policer of claim 38, further comprising: the filter further configured to  
2 calculate the average as an exponential weighted moving average (EWMA).

1 66. (New): The apparatus of claim 45, further comprising: means for calculating the av-  
2 erage as an exponential weighted moving average (EWMA).

1 67. (New): The medium of claim 52, further comprising the step of: calculating the av-  
2 erage as an exponential weighted moving average (EWMA).